

WHAT IS CLAIMED AS NEW AND IS DESIRED TO BE SECURED BY LETTERS
PATENTS OF THE UNITED STATES:

1. An automatic focusing device for a digital camera, comprising:
 - an optical system including a focusing lens system;
 - an imaging device which receives a light flux from an object to be photographed, the received light flux being passed through the optical system to form an image of the object, and converts the received light flux into an output image signal;
 - analog-to-digital converting means for converting the image signal to output digital image data;
- 10 automatic exposure (AE) evaluation value outputting means for outputting luminance data according to the digital image data as an AE evaluation value;
- automatic focusing (AF) area setting means for setting at least an area of an imaging screen of the imaging device as an AF area;
- AF area enlarging means for determining if the AE evaluation value is smaller than a predetermined value and setting an enlarged AF area as the AF area when the AE evaluation value is smaller than the predetermined value;
- AF evaluation value outputting means for integrating high frequency components of luminance data of image data in the AF area and outputting resulting data as an AF evaluation value;
- 20 AF evaluation value sampling means for enabling the AF evaluation value outputting means to sample AF evaluation values output by the AF evaluation value outputting means while moving the focusing lens system; and
- focusing lens driving means for determining if the device is in focus based upon a result of sampling the AF evaluation values and driving the focusing lens system to a

focusing position when the device is not in focus.

2. An automatic focusing device for a digital camera, comprising:

an optical system including a focusing lens system;

an imaging device which receives a light flux from an object to be photographed, the

5 received light flux being passed through the optical system to form an image of the object,

and converts the received light flux into an output image signal;

analog-to-digital converting means for converting the image signal to output digital

image data;

automatic exposure (AE) evaluation value outputting means for outputting luminance

10 data according to the digital image data as an AE evaluation value;

automatic focusing (AF) area setting means for setting at least an area of an imaging screen of the imaging device as an AF area;

AF evaluation value outputting means for integrating high frequency components of luminance data of image data in the AF area and outputting resulting data as an AF

15 evaluation value;

AF evaluation value sampling means for enabling the AF evaluation value outputting means to sample AF evaluation values output by the AF evaluation value outputting means while moving the focusing lens system;

focusing lens driving means for determining if the device is in focus based upon a 20 result of sampling the AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus; and

AF area enlarging means for setting an enlarged AF area as the AF area before the AF evaluation value sampling means samples the AF evaluation values when the AF evaluation

value is smaller than a predetermined value.

3. An automatic focusing device for a digital camera, comprising:

an optical system including a focusing lens system;

an imaging device which receives a light flux from an object to be photographed, the

5 received light flux being passed through the optical system to form an image of the object,

and converts the received light flux into an output image signal;

variable gain amplifying means for amplifying the image signal with a variable gain;

analog-to-digital converting means for converting the image signal to output digital

image data;

10 automatic exposure (AE) evaluation value outputting means for outputting luminance data according to the digital image data as an AE evaluation value;

automatic focusing (AF) evaluation value outputting means for integrating high frequency components of luminance data of image data in an AF area and outputting resulting data as an AF evaluation value;

15 AF evaluation value sampling means for enabling the AF evaluation value outputting means to sample AF evaluation values output by the AF evaluation value outputting means while moving the focusing lens system;

focusing lens driving means for determining if the device is in focus based upon a result of sampling the AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus; and

20 gain control means for controlling the variable gain amplifying means to increase the gain of the variable gain amplifying means while the AF evaluation value sampling means is sampling the AF evaluation values and when the AE evaluation value is smaller than a

predetermined value.

4. An automatic focusing device for a digital camera, comprising:

an optical system including a focusing lens system;

an imaging device which receives a light flux from an object to be photographed, the

5 received light flux being passed through the optical system to form an image of the object,

and converts the received light flux into an output image signal;

variable gain amplifying means for amplifying the image signal with a variable gain;

analog-to-digital converting means for converting the image signal to output digital

image data;

10 automatic exposure (AE) evaluation value outputting means for outputting luminance data according to the digital image data as an AE evaluation value;

automatic focusing (AF) evaluation value outputting means for integrating high frequency components of luminance data of image data in an AF area and outputting resulting data as an AF evaluation value;

15 AF evaluation value sampling means for enabling the AF evaluation value outputting means to sample AF evaluation values output by the AF evaluation value outputting means while moving the focusing lens system;

focusing lens driving means for determining if the device is in focus based upon a result of sampling the AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus; and

20 gain control means for controlling the variable gain amplifying means to increase the gain of the variable gain amplifying means while the AF evaluation value sampling means is sampling the AF evaluation values, when the AF evaluation value is smaller than a

predetermined value before the AF evaluation value sampling means samples the AF evaluation values.

5. An automatic focusing device for a digital camera, comprising:

an optical system including a focusing lens system;

5 an imaging device which receives a light flux from an object to be photographed, the received light flux being passed through the optical system to form an image of the object, and converts the received light flux into an output image signal;

10 analog-to-digital converting means for converting the image signal to output digital image data;

15 automatic exposure (AE) evaluation value outputting means for outputting luminance data according to the digital image data as an AE evaluation value;

automatic focusing (AF) evaluation value outputting means for integrating high frequency components of luminance data of image data in an AF area and outputting resulting data as an AF evaluation value;

20 AF evaluation value sampling means for enabling the AF evaluation value outputting means to sample AF evaluation values output by the AF evaluation value outputting means while moving the focusing lens system;

focusing lens driving means for determining if the device is in focus based upon a result of sampling the AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus;

25 AE control means for controlling an AE control operation in accordance with the AE evaluation value output by the AE evaluation value outputting means; and

AE setting means for setting an AE evaluation value for an AF area independently

from the AE control operation by the AE control means;

wherein, an AF operation is executed after the AE operation for the AF area is performed by the AE setting means for the AF area.

6. A method for controlling an automatic focusing device of a digital camera,
5 comprising:

receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

converting the image signal to output digital image data;

10 outputting luminance data according to the digital image data as an automatic exposure (AE) evaluation value;

setting at least an area of an imaging screen of an imaging device as an automatic focusing (AF) area;

15 determining if the AE evaluation value is smaller than a predetermined value and setting an enlarged AF area as the AF area when the AE evaluation value is smaller than the predetermined value;

integrating high frequency components of luminance data of image data in the AF area and outputting resulting data as an AF evaluation value;

sampling AF evaluation values while moving the focusing lens system; and

20 determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus.

7. A method for controlling an automatic focusing device of a digital camera,

comprising:

receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

5 converting the image signal to output digital image data;

 outputting luminance data according to the digital image data as an automatic exposure (AE) evaluation value;

 setting at least an area of an imaging screen of an imaging device as an automatic focusing (AF) area;

10 integrating high frequency components of luminance data of image data in the AF area and outputting resulting data as an AF evaluation value;

 sampling AF evaluation values while moving the focusing lens system; and

 determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in

15 focus; and

 setting an enlarged AF area as the AF area before sampling the AF evaluation values when the AF evaluation value is smaller than a predetermined value.

8. A method for controlling an automatic focusing device of a digital camera,

comprising:

20 receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

 amplifying the image signal with a variable gain;

converting the image signal to output digital image data;

outputting luminance data according to the digital image data as an automatic exposure (AE) evaluation value;

5 integrating high frequency components of luminance data of image data in an automatic focusing (AF) area and outputting resulting data as an AF evaluation value;

 sampling AF evaluation values while moving the focusing lens system;

 determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus; and

10 controlling the variable gain to increase the variable while sampling the AF evaluation values and when the AE evaluation value is smaller than a predetermined value.

9. A method for controlling an automatic focusing device of a digital camera, comprising:

 receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

15 amplifying the image signal with a variable gain;

 converting the image signal to output digital image data;

 outputting luminance data according to the digital image data as an automatic exposure (AE) evaluation value;

20 integrating high frequency components of luminance data of image data in an automatic focusing (AF) area and outputting resulting data as an AF evaluation value;

 sampling AF evaluation values while moving the focusing lens system;

determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus; and

controlling the variable gain to increase the variable while sampling the AF evaluation values, when the AF evaluation value is smaller than a predetermined value before the sampling the AF evaluation values.

10. A method for controlling an automatic focusing device of a digital camera, comprising:

10 receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal; converting the image signal to output digital image data; outputting luminance data according to the digital image data as an automatic exposure (AE) evaluation value;

15 integrating high frequency components of luminance data of image data in an
automatic focusing (AF) area and outputting resulting data as an AF evaluation value;
sampling AF evaluation values while moving the focusing lens system;
determining if the device is in focus based upon a result of the sampled AF evaluation
values and driving the focusing lens system to a focusing position when the device is not in
20 focus;

controlling an AE control operation in accordance with the AE evaluation value; setting the AE evaluation value for the AF area independently from the AE control operation; and

executing an AF operation after the AE operation for the AF area.

11. A computer readable medium storing computer instructions for controlling an automatic focusing device of a digital camera, by performing the steps of:

5 receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

converting the image signal to output digital image data;

outputting luminance data according to the digital image data as an automatic exposure (AE) evaluation value;

10 setting at least an area of an imaging screen of an imaging device as an automatic focusing (AF) area;

determining if the AE evaluation value is smaller than a predetermined value and setting an enlarged AF area as the AF area when the AE evaluation value is smaller than the predetermined value;

15 integrating high frequency components of luminance data of image data in the AF area and outputting resulting data as an AF evaluation value;

sampling AF evaluation values while moving the focusing lens system; and

determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus.

20 12. A computer readable medium storing computer instructions for controlling an automatic focusing device of a digital camera, by performing the steps of:

receiving a light flux from an object to be photographed, the received light flux being

passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

converting the image signal to output digital image data;

outputting luminance data according to the digital image data as an automatic

5 exposure (AE) evaluation value;

setting at least an area of an imaging screen of an imaging device as an automatic focusing (AF) area;

integrating high frequency components of luminance data of image data in the AF area and outputting resulting data as an AF evaluation value;

10 sampling AF evaluation values while moving the focusing lens system; and

determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus; and

setting an enlarged AF area as the AF area before sampling the AF evaluation values

15 when the AF evaluation value is smaller than a predetermined value.

13. A computer readable medium storing computer instructions for controlling an automatic focusing device of a digital camera, by performing the steps of:

receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

amplifying the image signal with a variable gain;

converting the image signal to output digital image data;

outputting luminance data according to the digital image data as an automatic

exposure (AE) evaluation value;

integrating high frequency components of luminance data of image data in an automatic focusing (AF) area and outputting resulting data as an AF evaluation value;

sampling AF evaluation values while moving the focusing lens system;

5 determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus; and

controlling the variable gain to increase the variable while sampling the AF evaluation values and when the AE evaluation value is smaller than a predetermined value.

10 14. A computer readable medium storing computer instructions for controlling an automatic focusing device of a digital camera, by performing the steps of:

receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

15 amplifying the image signal with a variable gain;

converting the image signal to output digital image data;

outputting luminance data according to the digital image data as an automatic exposure (AE) evaluation value;

integrating high frequency components of luminance data of image data in an

20 automatic focusing (AF) area and outputting resulting data as an AF evaluation value;

sampling AF evaluation values while moving the focusing lens system;

determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in

focus; and

controlling the variable gain to increase the variable while sampling the AF evaluation values, when the AF evaluation value is smaller than a predetermined value before the sampling the AF evaluation values.

5 15. A computer readable medium storing computer instructions for controlling an automatic focusing device of a digital camera, by performing the steps of:

receiving a light flux from an object to be photographed, the received light flux being passed through an optical system having a focusing lens system to form an image of the object and converting the received light flux into an output image signal;

10 converting the image signal to output digital image data;

outputting luminance data according to the digital image data as an automatic exposure (AE) evaluation value;

integrating high frequency components of luminance data of image data in an automatic focusing (AF) area and outputting resulting data as an AF evaluation value;

15 sampling AF evaluation values while moving the focusing lens system;

determining if the device is in focus based upon a result of the sampled AF evaluation values and driving the focusing lens system to a focusing position when the device is not in focus;

controlling an AE control operation in accordance with the AE evaluation value;

20 setting the AE evaluation value for the AF area independently from the AE control operation; and

executing an AF operation after the AE operation for the AF area.